

# **The Credit Channel at Work: Lessons from the Republic of Korea's Financial Crisis**

by  
**Giovanni Ferri and Tae Soo Kang\***

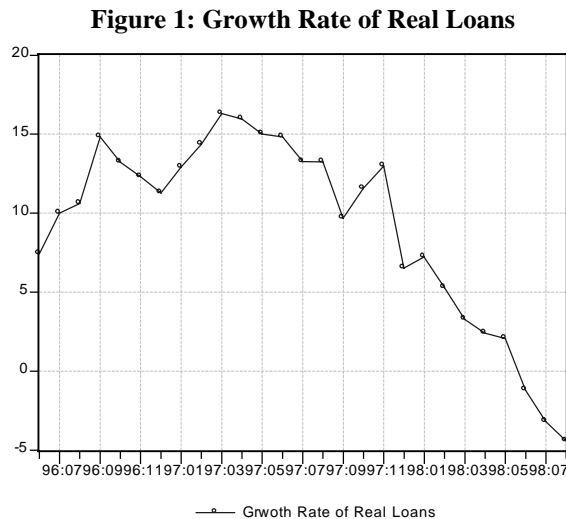
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\* The authors are economists with the World Bank, respectively in the EASFS and DECRG units; in addition, they are affiliated, respectively, with the Università di Bari (Italy) and the Bank of Korea. Without involving them in any errors, the authors are indebted to Gerard Caprio, Jr., Ilker Domaç, Patrick Honohan, Constantijn Classens, Leora Klapper, Maria Soledad Martinez Peria, Jacques Loubert, Mohammad Zia Qureshi, and Swati Ghosh for suggestions and stimulating discussion, and to Raoul Minetti for his support in estimating the 'capital crunch' hypothesis. The authors are also grateful to participants in seminars at the Korea Institute of Finance, where a preliminary draft received very useful comments, and at the World Bank. They would also like to thank staff at both the Bank of Korea and Korea's Financial Supervisory Committee for valuable help in obtaining the data, and Hosook Hwang for her dedication in the data management. The findings and conclusions of the paper are those of the authors. They do not necessarily represent the views of the World Bank, its Executive Directors, or the countries they represent.

## Introduction

When a negative shock hits the economy, a chain of reactions can produce detrimental effects that go well beyond the original size of the shock. Part of the explanation for this "over-reaction" in the economy may be found in financial factors. Specifically, owing to the pervasive asymmetric information problems permeating it, the financial system may amplify the impact of the shock by disproportionately aggravating the availability and cost of external finance to businesses. This propagation mechanism is, in fact, exactly what the literature on the credit channel of transmission attempts to explain (Bernanke, Gertler and Gilchrist, 1996). A clear-cut identification of the contractionary effect induced by the banking system is, however, extremely difficult to interpret with the empirical evidence (Bernanke and Gertler, 1995; Hubbard, 1995), since the size of the negative shock is typically relatively small. Accordingly, large negative shocks make it easier to determine the role of the banking system in the propagation mechanism. The recent experience of Korea is particularly telling in this respect; indeed, it appears almost as a laboratory experiment for testing the existence and importance of the credit channel.

At the end of 1997, Korea experienced a sharp exchange rate devaluation – which was largely unanticipated, at least in its magnitude. This, in turn, triggered an unprecedented banking crisis. The banking crisis unfolded as heavy losses mounted on the large unhedged foreign currency debt, and as domestic interest rates rapidly increased – in response to swift monetary restriction to restore market confidence – as asset markets (stocks and real estate) collapsed.



Macro variables, such as monetary and credit aggregates, may be unable to fully capture the possible retrenchment in banks' loan supply following the shock (Bernanke and Gertler, 1995). For instance, although the growth of aggregate real credit in Korea did slow down after the crisis (Figure 1), one cannot determine whether this was the

result of either demand or supply effects. This uncertainty implies that we need to resort to other strategies for identification. One such strategy consists of analyzing interest rate spreads between various classes of borrowers. This is precisely the avenue taken by Ding, Domaç, and Ferri (1998), who conclude that a severe credit crunch ensued in Korea. Specifically, they find that the crisis caused sharp increases in the spread between corporate and government bond yields – reflecting a worsening of the general risk premium, or the balance sheet effect. They also find that the spread between bank lending rates and corporate commercial paper yields reflects the specific worsening of credit terms for bank dependent borrowers (mostly Small and Medium-Sized Enterprises, SMEs), or the lending channel effect.<sup>1</sup>

Although suggested by the results above, verifying the existence of credit channel effects calls for further analysis. This is the direction taken in this paper, which uses micro-data gathered at the individual bank level to refine the identification of credit channel effects for Korea. In particular, we want to test three hypotheses.

First, in order to rule out distortions due to aggregation, we want to investigate whether bank lending rates increased relative to corporate commercial paper rates for each and every bank.

Second, partly in analogy to Morgan (1998) but taking a different approach, we focus on two particular types of debt contracts: overdraft loans outstanding – more demand driven – and overdraft credit limits – more supply driven. Accordingly, two types of evidence can identify banks having become more restrictive after the monetary tightening: i) if we observe that borrowers' reliance on pre-committed credit lines has increased, this may imply that obtaining new loans has become more difficult; ii) if we find that credit limits shrink, this may be interpreted as evidence of an adverse shift in supply.

Third, particularly considering the increased attention that Korean authorities attributed to banks' BIS capital adequacy,<sup>2</sup> we test whether banks which were (becoming) less well capitalized became more restrictive than the others after the crisis. In particular, we follow the approach proposed by Peek and Rosengren (1995), who argue that capital-unconstrained banks should react to negative shocks to capital by intensifying deposit taking. Thus, if we were to find a positive relationship – rather than the expected

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<sup>1</sup> Still referring to Korea, Domaç and Ferri (1998) show that the above interest rate spreads, capturing credit channel effects, Granger-cause production; they also show that causality is stronger for SMEs' production. In addition, the impact on production of these interest rate spreads is sizable, and is larger for SMEs.

<sup>2</sup> To restore market confidence in domestic banks, the newly established Financial Supervisory Committee (FSC) promptly stiffened the enforcement of BIS capital adequacy ratios. Banks should hold a BIS ratio of at least 6% by March of 1999 and 8% by March of 2000. Moreover, FSC took decisive measures in June of 1998. Out of 26 commercial banks with BIS ratio lower than 8%, 5 were closed, 6 are undergoing M&A, 2 will be sold to international bidders, and 5 will adopt self-rehabilitation plans. For newly merged banks, a BIS ratio of 10% will be maintained with government support.

negative relationship – between shocks to capital and deposit taking, this would provide evidence that banks are capital-constrained.

The remainder of the paper is structured as follows. Section 2 summarizes the results already obtained in the available literature on the credit channel in Korea and presents some relevant descriptive evidence. In Section 3, we set out the hypotheses to be tested, discuss their rationale with reference to the relevant literature and describe our methodology in detail. The main econometric results are presented in Section 4, while the final Section draws policy recommendations and concludes the study.

### **The ‘credit crunch’ in the Korean crisis: some background**

The Korean crisis – together with the Thai and Indonesian crises – has been studied, not only extensively, but from many different perspectives (See, among others, World Bank, 1998; Krugman, 1998; Corsetti, Pesenti, and Roubini, 1998; Furman and Stiglitz, 1998; Caprio, 1998).<sup>3</sup>

It is generally held that loss of confidence in the Korean economy led to market reactions which went well beyond what was justified by Korean imbalances. This over-reaction by markets led to the unprecedented currency crisis. A twin banking crisis unfolded as heavy losses mounted on the large unhedged foreign currency debt, as asset markets (stocks, real estate, and bonds) deteriorated, and as domestic interest rates increased rapidly – in response to swift monetary restriction aimed at restoring market confidence.

As a result of this crisis, Korea experienced the harshest economic recession of its entire post-war history. Industrial production dropped by 12 % between August 1997 and August 1998, while business investment decreased by 28.3 % in the third quarter of 1998 when compared to the same period of the previous year. Corporate bankruptcies reached an unrecorded high of 3,197 firms during December of 1997.<sup>4</sup> Layoffs were extensive, leading to 7.4% unemployment in August 1998. The normal operation ratio of SMEs for

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<sup>3</sup> The Asian crisis has spawned several websites. A frequently referred one is Nouriel Roubini’s at [www.stern.nyu.edu/~nroubini/asia/AsiaHomepage.html](http://www.stern.nyu.edu/~nroubini/asia/AsiaHomepage.html).

<sup>4</sup> Among them were 22 listed companies – including several securities companies. The 3,197 bankruptcies compare with a monthly average of 965 during 1996. Corporate bankruptcies in 1998 remain still higher than in 1996 and 1997 (1996: 11,589, 1997: 17,168, 1998: 22,828). Although declining later in 1998, the share of dishonored bills reached an historical maximum at the end of 1997:

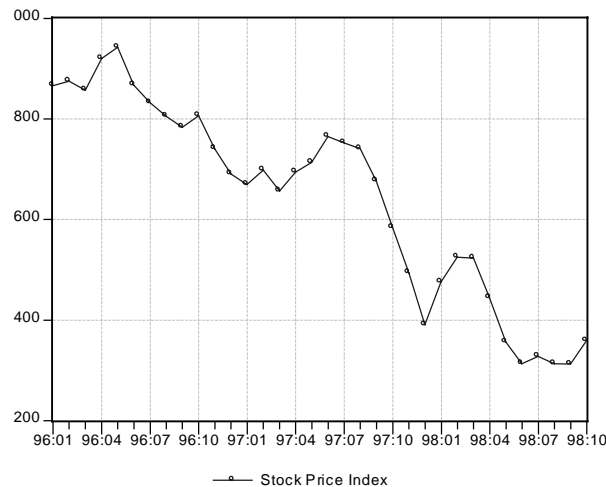
Share of Dishonored Bills					
1996. 12	1997. 12	1998. 1	1998. 3	1998. 6	1998. 12
0.17%	2.09%	0.72%	0.62%	0.58%	0.12%

March of 1998 (69.3%) was down 14.5 percentage points from twelve months earlier, touching the lowest level since October of 1981 (67.4%).<sup>5</sup>

The drop in private household expenditures was also dramatic: 12.1% for overall consumption and 44.3% for durable goods consumption during the third quarter of 1998. Housing and land prices dropped by 11% during the period January-June 1998. The marked decline was evident in the stock market between August, 1997 and August, 1998: the composite stock price index fell precipitously by 55% (Figure 2).

The question has been repeatedly asked whether the initial policy measures adopted by the Korean authorities in response to the crisis have been, to some extent, counterproductive. Specifically, swift monetary restriction has been criticized because: i) after the crisis, higher rates might be unable to attract back investors who had by now ‘crossed-out’ East Asian assets instead of considering them a ‘must buy’, as they had before; ii) ‘over-leverage’ and exposure to financial risks made the Korean economy extremely vulnerable to high interest rates (Goldstein 1998).

**Figure 2: Stock Price Index**



More specifically, the monetary restriction could well have further depressed Korea because of the magnifying transmission of the adverse shocks through the economy via the ‘credit channel’.

In order to better understand how this ‘channel’ transmits monetary/financial shocks to the economy, it is important to sketch the framework of the three major components of the ‘credit channel’: balance sheet, bank lending channel, flight to quality.

The balance sheet effect underscores the depressing impact of monetary tightening on borrowers’ assets and profits, by affecting variables such as borrowers’ net worth, cash flow and liquid assets; this depressing impact thus increases the risk premium on external

<sup>5</sup> The Korean Federation of Small Businesses performs this regular survey on the operating situation of SMEs’ normal operation ratio – i.e. the share of enterprises whose operation ratio (output/productive capacity) is greater than 80%.

funds. The increase in the premium on external funds amplifies the spending effect of a rise in interest rates (Gertler and Gilchrist, 1994). This occurs because the increased risk premium reduces both business profits and the asset value that firms have posted as collateral.

The bank lending channel effect refers to the scaling-back of bank loans in the event of monetary tightening. The monetary squeeze raises the level of interest rates even for risk-free assets. In general, banks cannot proportionately increase deposit rates since they must build non-interest bearing required reserves. Thus, banks suffer a deposit drain as investors reshuffle their portfolio, away from deposits, and toward assets with more attractive yields. For their part, banks are not indifferent between making loans to the corporate sector and holding government securities. Since government securities provide a cost efficient way to carry secondary liquidity cushions, banks may be unwilling to reduce their holding of such securities below some threshold. Following the deposit drain, they will probably be more reluctant with their loan supply. If, as it happens, not all firms are indifferent between borrowing from banks and issuing debt on the market, this implies that banks lending rates should increase more than corporate debt market rates. In reality, however, we know that the majority of businesses do not issue debt on the market. Consequently, after the monetary squeeze we can expect that the wedge between bank lending rates and corporate debt market rates may also increase.<sup>6</sup>

Finally, we build on those studies which hypothesize that credit channel effects are likely to be most important for those firms that, being unable to issue debt on the market, can be classified as bank-dependent borrowers. This suggests that the credit channel will particularly penalize the Small and Medium-sized Enterprises (SMEs),<sup>7</sup> most of which are *de facto* bank-dependent borrowers.<sup>8</sup> An additional reason SMEs are disproportionately affected by credit channel effects derives from the possibility that the monetary squeeze triggers a flight-to-quality in bank lending. More specifically, banks may respond to the monetary restriction, not only by generally restraining credit, but also by adopting more stringent lending policies for those customers that are perceived to be less credit-worthy.<sup>9</sup> That is, when a deposit drain squeezes their resources, banks will try to select customers who are *ex ante* more credit-worthy: e.g. those with a more established credit record or those able to post more collateral.<sup>10</sup> A final ingredient that

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<sup>6</sup> A similar impact could be induced by the introduction of stricter regulations on banks: e.g. the imposition of higher capital adequacy ratios (Bernanke and Lown, 1991). See also below.

<sup>7</sup> Gertler and Gilchrist (1994) show evidence consistent with this hypothesis.

<sup>8</sup> First, SMEs are too small to justify the fixed costs entailed by listing securities. Second, were they to consider issuing debt on the market, they will most likely find it unattractive since, given the low liquidity of their debt, investors would ask for very high yields.

<sup>9</sup> Bernanke, Gertler, and Gilchrist (1996) report evidence consistent with this hypothesis. A negative bias similar to that regarding SMEs might apply to fast-growing firms, since they have a higher ratio of expected future profits to the current value of physical assets and thus can provide lower collateral.

<sup>10</sup> Lenders perceive SMEs to be more risky since they generally have a shorter track record and typically release less — and less structured — information.

suggests SMEs are disproportionately penalized by the credit channel derives from the possibility that, when a financial crisis ensues, depositors may also enact a flight to quality (safety). Envisaging increased fragility of the financial intermediaries, depositors may shift their savings towards institutions that are perceived as less likely to go bankrupt. Depositors may well believe that the government will bail out a large bank before a small one. Accordingly, small banks are the ones to suffer hardest in the deposit flight. Furthermore, it is likely that the banks which receive new flows of funds have no established relationship with the borrowers of those institutions losing resources. Accordingly, the institutions receiving new flows are not likely to make loans to those borrowers. In this case, an additional credit squeeze may hit those customers borrowing from small banks,<sup>11</sup> and, typically, SMEs which, more than other firms, depend on small banks' lending.<sup>12</sup>

Whereas the 'balance sheet' effect does not presuppose market failure, both the bank lending channel and the flight-to-quality effects stem from the existence of market failures due to asymmetric information and the related incentive problems.

Some papers have already focused on the impact of financial factors in the Korean crisis. Some have indeed used the interpretative framework we just summarized. Ding *et al.* (1998) identify a *credit crunch* in Korea; they do so by observing sharp increases of both the spread between corporate and government bond yields – reflecting a deterioration of the general risk premium, or the balance sheet effect – and the spread between bank lending rates and corporate commercial paper yields, reflecting the specific worsening of credit terms for bank dependent borrowers (mostly SMEs), or the lending channel effect. Domaç and Ferri (1998) show that increased interest rate spreads – indicating credit tightening – do indeed predict a slowdown in economic activity and that this effect is stronger for SMEs. Bongini *et al.* (1998) find that high reliance on bank loans – possibly associated with strong bank-firm relationships – reduces the risk of bankruptcy for non-*Chaebol* firms. Kim (1998) uses both a VAR approach and the estimation of separate demand and supply equations to conclude that forceful credit channel effects have taken place in Korea in the aftermath of the crisis.<sup>13</sup>

The above papers suggest that a credit channel of transmission was at work in amplifying the adverse impact of monetary/financial shocks through the Korean economy. Most of this evidence, however, is based on aggregate data and thus possibly subject to aggregation problems. As such, the above papers may have fallen short of

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<sup>11</sup> Kashyap and Stein (1994, 1997) argue that small banks, rather than large ones, are more likely to be hit by monetary restrictions.

<sup>12</sup> Berger *et al.* (1995) document, in the U.S., a strong correlation between relative size of the lending bank and that of the borrowing firm: i.e. small firms tend to borrow from small banks and large firms to borrow from large banks. Angeloni *et al.* (1995) present analogous evidence for Italy.

<sup>13</sup> It should also be mentioned that Ghosh (1998) still using the separate credit demand and supply function, finds a credit crunch only until the end of 1997. The approach differs from that of Kim (1998) and Pazarbasioglu (1997) in that lending capacity of banks, defined as the minimum of the capital and liquidity constraints, is taken as an explicit determinant in the supply curve.

solving the problem of identifying supply effects distinct from demand ones, which is fundamental in proving the impact of the credit channel.

The approach taken in this paper is different, and focuses on individual banks' data. Using micro-data allows us to free our results from possible aggregation bias. Moreover, using both the time series and the cross-sectional dimensions, we are able to conduct more robust tests of the existence of credit channel effects than previous papers.



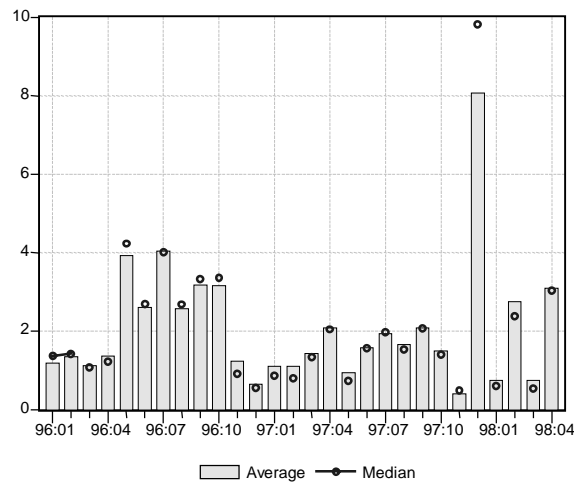
## Hypotheses and methodology

### *Hypothesis 1: Monetary Tightening Widens the Spread Between Individual Bank's Marginal Lending Rates and Corporate Commercial Paper Rates*

In order to rule out distortions due to aggregation, we shall investigate whether marginal lending rates (overdraft rates) increased more at most banks than the corporate commercial paper rates did after the monetary/financial shocks.

To assess the impact attributable to credit channel effects, we take the spread between marginal bank lending rates and corporate commercial paper rates as representative of the bank lending channel. To do this, we could select either the rate on general loans or the rate on overdraft loans. The rate on general loans is quite sticky relative to the money market rates. Such stickiness stems from banks' rate setting, which does not reflect market conditions, and, as such, might not be fully indicative of the terms at which business may obtain new loans. This pattern arises even without considering that lending rate stickiness could be associated with larger quantity rationing of loans.<sup>14</sup> This is the main reason why we decided to adopt the overdraft rate, which seems to be the one that promptly reflects changes in banks' cost of funds.<sup>15</sup>

**Figure 3. Trend of SPA**



<sup>14</sup> Stiglitz and Weiss (1981) show that banks may refrain from raising lending rates and may rely more on credit rationing due to asymmetric information and the resulting adverse selection problem.

<sup>15</sup> To the extent that we want to take a lending rate which is representative of the conditions at the margin, the fact that overdraft loans constitute only 5 to 6 % of total loans at Korean banks has little consequence for us. The overdraft rate is determined and announced on a daily basis by individual commercial banks considering the following factors: average funding costs including inter-bank overnight borrowing rate (call money rate), inter-bank CD and RP rates; forecasted level of overdraft rates based on each bank's own econometric model, and other banks' level of overdraft rates.

Hypothesis 1 is particularly important in recognizing a bank lending channel. If the decline in bank loans is coupled with a widening spread between bank lending rates and the rates on analogous non-bank debt market instruments, then an adverse shift in banks' loan supply is proved. In fact, either supply has declined whereas demand has not, or supply has declined more than demand (Bernanke and Gertler, 1995).

Figure 3 shows that such spread (SPA) increased in both the average and the median, although remarkably so only in December 1997, likely reflecting perturbations in the commercial paper market.<sup>16</sup>

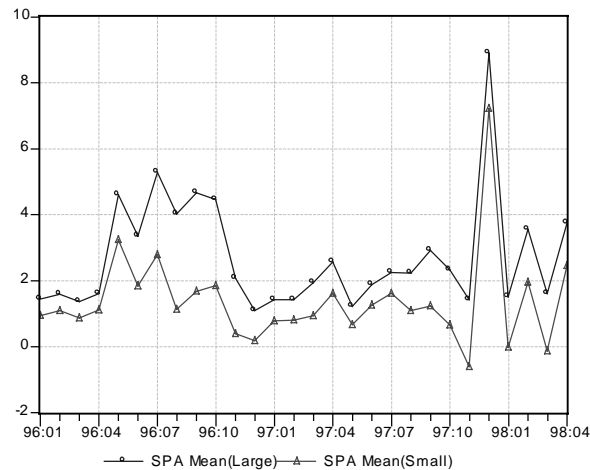
**Table 1: Trends of Corporate Bonds Issuance Ratios by Firm Size**

	(unit: %, billion won)				
	1996	1997	Jan. ~ Oct. 97	Jan. ~ Oct. 98	Oct. 98
Large Firms	88.7	94.2	92.4	99.4	7,421 (99.3)
SMEs	11.3	5.8	7.6	0.6	55 (0.7)
Total	100.0	100.0	100.0	100.0	7,476 (100.0)

Source: The Bank of Korea

Before moving further to test our hypotheses more formally, we must address a caveat regarding the relevance of SPA. In particular, one could claim that SPA is a hybrid measure. If the overdraft lending rate represents the marginal cost of funds for SMEs while the marginal cost of funds for other firms is the yield on market debt, changes in the spread between overdraft rates and commercial paper yields could simply reflect changes in the risk premium differential between SMEs and other firms.

**Figure 4: Trend of SPA for Large Firms and SMEs**



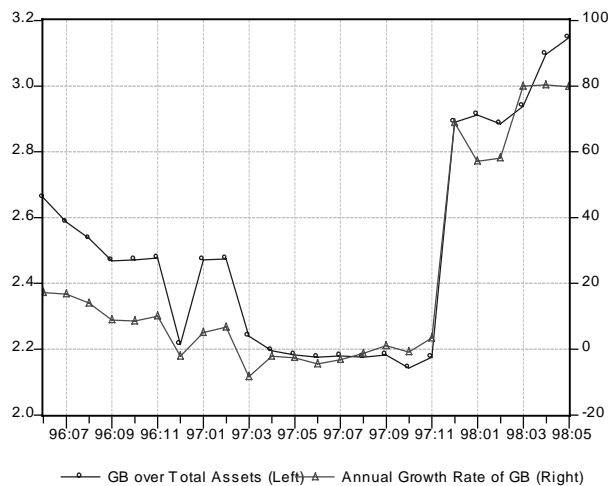
<sup>16</sup> In December of 1997, and in the following months, the Korean CP market was perturbed by widespread difficulties at several merchant banks, i.e. those intermediaries specialized in underwriting and trading CP. Such perturbation – reducing the liquidity of the CP market – could have caused a special temporary increase in CP rates. This conjecture is consistent with the fact that the differential between CP rate and 91-day CD rates grew markedly higher, not only in December of 1997, but also in the following months. Thus, our reliance on SPA obfuscates the rise in bank lending rates. This, however, leaves SPA still fit to identify the cross-sectional differences across banks.

In this respect, Table 1 confirms that SMEs do, in fact, have little access to the issuance of debt on the market. It confirms that, for SMEs, such sources of funds seem to have dried up even more during the crisis: e.g. the share of corporate bonds issued by SMEs dropped to 0.6% during the first ten months of 1998, from 7.6% in the same period of 1997.

Thus, in order to identify that the increase in SPA is actually associated with a retrenchment in banks' supply of loans, we need to show that the spread increases for both small and large firms. Supporting evidence is shown in Figure 4: effectively, SPA increases, not only for SMEs, but also for large firms (prime customers).

Turning to further indications of credit channel effects, Figure 5 shows a good example of flight-to-quality by banks. The Figure reports the growth rate of government bonds and the share of government bonds over the total assets. Evidently, there is a shift of banks' assets towards government securities.

**Figure 5. Trend of the Growth Rate of Government Bonds**



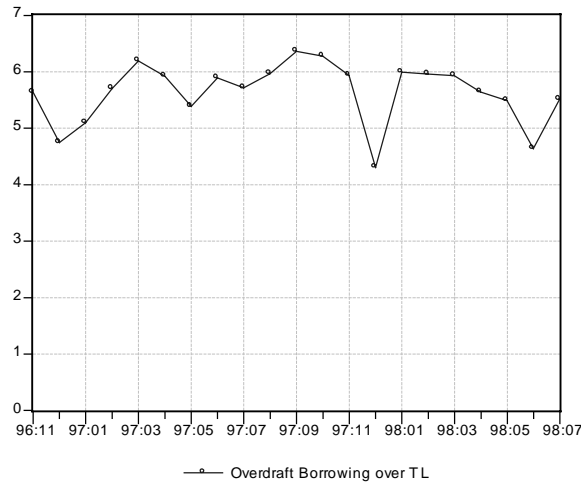
### *Hypothesis 2: Credit Limits on Overdrafts React Negatively to the Monetary Tightening*

Partly in analogy to Morgan (1998) but taking a different approach, we bolster the identification of supply shifts by focusing on a particular type of debt contracts: namely, overdraft credit limits that seem more supply driven<sup>17</sup> relative to other loan contracts.

<sup>17</sup> The share of overdraft credit drawn out of overdraft credit limit stands at 26.5% as of October 1998. This implies a marked drop from the ratio of 32.0% in October 1997. Such a drop may largely be due to the higher lending rates: once a firm obtains the credit line, it can freely access to this facility without extra cost so that a firm redeems its overdraft loans if overdraft rates are higher than market debt rates.

Using a contractual difference across bank loans, Morgan (1998) shows that those bank loans not made under a commitment slow after tight monetary policy, while loans under commitment accelerate or remain unchanged. The crucial identification issue is whether this divergence reflects a reduction in the supply of loans to the firms without commitment, or merely reduced demand for credit by those firms. To help distinguish between these interpretations, Morgan examines the responses of bank loan officers and small firms to survey questions about the availability of credit. Both lenders and small firms report reduced credit availability at times when the share of loans not under commitment is declining, suggesting that the divergence reflects a reduction in loan supply.

**Figure 6-a: Share of Overdraft Borrowing on Total Loans (26 Commercial Banks)**



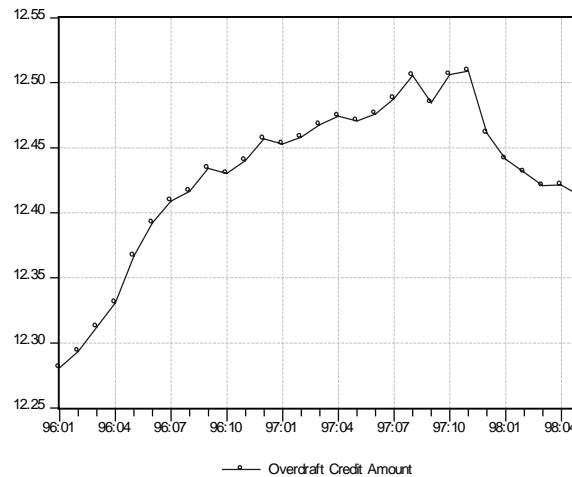
The situation in Korea, however, differs from that of the U.S. credit market on which Morgan based his study. Korean commercial banks do not offer loans under commitment. Instead, they offer overdraft credit lines to qualified borrowers:<sup>18</sup> credit lines are offered at no charge, i.e. there is no commitment fee. This is different from the US but similar to other countries e.g. Italy. Borrowers pay the loan rate only on the part of the credit line which is actually drawn; the remaining part of the credit line bears no cost. The undrawn part of the line may be thought of as an option with zero price for the borrower (Conigliani *et al.* 1997). Given the lack of pecuniary cost in demanding larger credit lines, firms have an incentive to demand credit lines as large as they can, in a way to cushion unexpected liquidity shocks. Thus, it is solely the bank that determines the credit limit, thereby rationing the amount that would be demanded by each borrower. Given the lack of pecuniary cost for the undrawn part, it would also be particularly

<sup>18</sup> Eligibility criteria for overdraft borrowers, and methods of determining credit limits, differ across banks. In general, the following variables are considered: i) duration of the bank-customer relationship; ii) average balance of deposits; iii) creditworthiness of the borrower; iv) amount of collateral; v) borrowers' balance sheet conditions; and vi) loan officer's overall judgement.

difficult to imagine that firms ask that their lines be reduced in a period of tight liquidity.<sup>19</sup>

As Figure 6-a shows, the share of overdraft borrowing on total loans does not increase in the Korean case after the monetary tightening. Nevertheless, credit limits on overdraft (the supply-driven variable) decline significantly (Figure 6-b). Since, according to the above conjecture, borrowers have no interest in asking for a reduction of their credit limits, such decline signals the retrenchment of banks' supply of loans.

**Figure 6-b: Volume of Credit Limits on Overdrafts  
(14 Nationwide Commercial Banks)**



### *Hypothesis 3: Banks That are Less Capitalized Will Become More Restrictive in Their Lending and Deposit Taking Behavior*

We now address the issue of whether those banks that were less well capitalized, or were becoming less well capitalized, became more restrictive than the others after the crisis.

After the crisis, the Financial Supervisory Board ordered a fast and decisive recovery of BIS capital adequacy ratio (8%) for all commercial banks. Several observers, however, have noted that pushing commercial banks through reinforcing provisioning requirements and loan classifications in such a short period could add pressure on banks to become more liquid, thereby possibly hindering their lending.

<sup>19</sup> To be sure, although credit lines are offered with no pecuniary cost and no collateral to qualified firms, the other firms have the line at no pecuniary cost but are required to post collateral. Accordingly, since posting collateral entails a cost, the conjecture that credit lines are strictly supply-determined might not hold for this second class of firms. In any case, even for this second class of firms, it seems reasonable to identify reductions in credit lines as the result of banks' autonomous decision. In fact, it is doubtful that even these firms will ask to have their credit lines curtailed at a time of stringent liquidity.

The issue of whether the stiffening of capital adequacy can lead to a contraction in banks' supply of loans has been debated at length in trying to explain the early 1990s US recession. By historical standards, this recession was rather mild and yet recovery was extremely slow. Various authors have suggested that the reason for such extremely slow recovery must be found in the capital crunch, a particular type of credit crunch. Specifically, the authors pointed to a retrenchment in banks' loan supply precipitated by the inception of the BIS capital adequacy standards in the U.S. The consequent failure of the banking system to play its normal role in the transmission of the monetary policy stimulus would have prevented the economy from responding to sizable interest rate cuts.

According to the definition proposed by the Council of Economic Advisors (1992), a credit crunch is "*a situation in which the supply of credit is restricted below the range usually identified with prevailing market interest rates and the profitability of investment projects*". Various explanations<sup>20</sup> account for banks' desire to retrench their loan supply following a monetary tightening or some other negative shock to the economy. It is argued that the introduction of the BIS capital standards induced a credit crunch by making it more costly for banks to hold loans instead of government securities.<sup>21</sup>

Various authors, using different methodologies, have contributed to this interpretation.<sup>22</sup> Among the relevant papers which have used cross-sectional bank-level data, Bernanke and Lown (1991) show that loan growth at individual banks between 1990:Q2 and 1991:Q1 was positively linked to initial capital ratios. Peek and Rosengren (1995) argue that capital-unconstrained banks should react to negative shocks to capital by intensifying deposit taking. When banks are not capital-constrained, one should thus expect a negative relationship between shocks to capital and deposit taking. On the contrary, they find a positive link between shocks to capital and the dynamics of deposits in 1990. They offer this as evidence supporting the pervasiveness of capital constraints for banks as the BIS ratios were phased in; indeed, they show that this impact is larger for banks having lower initial capital ratios. Berger and Udell (1994) concur that the expansion of loans was lower in 1990-92 for less-capitalized banks, but they do not detect that the sensitivity of loan expansion to capital ratios had increased with respect to the recession of the early 1980s. All in all, most published works on this issue<sup>23</sup> support the

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<sup>20</sup> Two survey contributions detailing on this are Bernanke and Gertler (1995) and Hubbard (1995).

<sup>21</sup> According to the BIS rules, loans to the private sector require the bank to post a minimum of 8% in qualifying capital equivalent, whereas credits on the State sector bear a zero requirement. In the U.S.A., BIS capital standards were formally approved in 1989, and phased in at the end of 1990.

<sup>22</sup> On theoretical grounds, Holmstrom and Tirole (1997) develop a model which provides a rationale for applying looser banking norms in recessions. In a model in which agents in both the real and the financial sector may be capital constrained, Holmstrom and Tirole conclude that intermediaries should satisfy market-determined capital adequacy ratios but these ratios should be procyclical, i.e. higher during expansions and lower during recessions.

<sup>23</sup> A notable exception is Sharpe (1995), who presents a survey of this literature and a critical review of research findings. He argues that the evidence in favor of a capital crunch is far from conclusive, the only exception being the evidence for banking in New England where the evidence supporting a capital crunch is reasonably firm.

hypothesis that the capital crunch adversely affected loan expansion in the US at the beginning of the 1990s.

**Table 2: Variable Definition**

Variable	Definition
<i>(For Hypothesis 1 and 2)</i>	(Based on 14 nationwide commercial banks)
SPA	Spread between the average overdraft lending rates and corporate commercial paper rates (*)
$\Delta RP$	Changes in the rates of central bank RPs which are used in its implementation of open market operations
$\Delta LCL$	changes in the log of overdraft credit limits (*)
$\Delta CPR$	changes in corporate commercial paper rates
$\Delta GBL$	changes in the ratio of government bonds over the sum of government bonds and bank loans (*)
<i>(For Hypothesis 3)</i>	(Based on 25 commercial banks)
$\Delta D/A$	ratio of changes in deposit over the beginning-of-period value of total assets (*)
$\Delta L/A$	ratio of changes in corporate loans over the beginning-of-period value of total assets (*)
$\Delta K/A$	ratio of change in equity capital over total assets (*)
BLR	bad loans ratio (*)
NPLR	non-performing loans ratio (*)

Note: (\*) bank-specific variable

### *Methodology*

We test the three hypotheses by means of time series-cross sectional regressions. Specifically, we estimate panel regressions across banks and months. In testing hypotheses 1 and 2, we use data for the 14 nation-wide commercial banks (total panel observations 168) since the information on credit limits on overdraft was available only for these banks. To test hypothesis 3, we include data for all 25 commercial banks (both nation-wide and local banks). In this case, the cross-sectional regressions are performed over the period December, 1996 to December, 1997 and February, 1997 to February, 1998.

### *Data Source and Summary Statistics*

Table 2 reports the definition of the variables employed in the regressions.<sup>24</sup>

Table 3 contains some descriptive statistics of the variables used later in the regressions.

**Table 3: Summary Statistics**

Variable	Mean	Median	Maximum	Minimum	Standard Deviation
(97.4-98.4)					
SPA (*)	2.2547	1.6093	10.1692	0.5428	2.4844
$\Delta$ RP	0.7408	-0.1300	12.7900	-4.6400	4.4133
RP	17.6146	13.3100	30.5500	11.3500	6.9033
$\Delta$ LCL (*)	-0.0059	-0.0028	0.0169	-0.0425	0.0186
$\Delta$ CPR	0.6800	0.2700	12.5200	-4.5200	4.1703
$\Delta$ GBL (*)	0.00016	0.0003	0.1360	-0.1435	0.0241
(96.12-97.12)					
$\Delta$ K/A (**)	0.0020	0.0012	0.0289	-0.0352	0.0128
$\Delta$ SPA (**)	7.4314	8.8700	10.5200	-4.1200	4.2226
$\Delta$ L/A (**)	0.0487	0.0456	0.1301	-0.0344	0.0347
$\Delta$ D/A (**)	0.0388	0.0223	0.2341	-0.0732	0.0716
BLR (***)	1.8680	1.7500	5.2250	0.3250	1.2357
NPLR (***)	5.2360	4.7000	12.8000	1.0750	2.8148
(97.2-98.2)					
$\Delta$ K/A (**)	-0.0054	-0.0097	0.0448	-0.0537	0.0222
$\Delta$ SPA (**)	1.6400	1.5800	3.9300	-2.0200	1.2629
$\Delta$ L/A (**)	0.0562	0.0565	0.1518	-0.0435	0.0416
$\Delta$ D/A (**)	0.0508	0.0396	0.2219	-0.0278	0.0684
BLR (***)	2.8280	2.6000	9.4500	0.5250	2.0842
NPLR (***)	6.3520	6.2500	13.9750	1.4750	3.2823

Note: (\*) monthly average value across 14 commercial banks; (\*\*) 25 banks' yearly change of equity capital ( $\Delta$ K), deposit ( $\Delta$ D), and loans ( $\Delta$ L) normalized by the beginning-of-period value (1997. 12 and 1998. 2) of total assets.; (\*\*\*) 25 banks' four-quarter average value.

First, a few remarks are in order concerning the variables used to test hypotheses 1 and 2. The extent of monetary tightening is demonstrated by the Bank of Korea's intervention rate (RP) touching a peak at 30.55% in January of 1998. This was almost three times as high as its lower level over the period of April, 1997 through April, 1998. Such a pattern determined a maximum month-to-month change ( $\Delta$ RP) of 12.79%. Still

<sup>24</sup> Bank-specific data for this study were kindly provided by the Bank of Korea and by the Financial Supervisory Committee.



on a month-to-month basis, the individual bank spread between its overdraft lending rate and the commercial paper rate (SPA) reached a maximum of 10.17%, again in January of 1998. At the same time, consistent with what Figure 6-b shows for the aggregate, the percentage increase of individual banks' overdraft credit limits ( $\Delta LCL$ ) became negative, becoming as low as minus 4.25%.

Second, something must be said regarding the variables employed to test hypothesis 3. Shocks to capital ( $\Delta K/A$ ) were still slightly positive for the median bank over the first period (December 1996-December 1997) but became negative 0.97% over the second period (February 1997- February 1998). However, even in the first period, some banks were already experiencing negative capital shocks – the minimum value of  $\Delta K/A$  was negative 3.52%. The extent of negative capital shocks increased over the second period – the minimum value of  $\Delta K/A$  became then negative 5.37%. In addition, the bad loan and non-performing loan ratios (respectively BLR and NPLR) exhibit substantial variability across banks. The dynamics of loans also show profound variability across banks: the median and minimum rates of growth were respectively positive 5% and negative 4%.

Finally, deposits will require additional analysis in the econometric testing. The median and minimum rates of growth were respectively positive 4% and negative 3% over the second period, whereas they were respectively positive 2% and negative 7% over the first period. That the variability across individual banks' deposit taking is larger in the first period than it is in the second period may be associated with depositors' flight to quality. In fact, depositors' flight to quality was reportedly most intense in December of 1997, as the crisis unfolded. Flight to quality supposedly consisted of deposits shifting from small to large banks, as the latter were perceived "too big to fail" or simply more likely to receive public sector support in case of difficulty. Accordingly, in our regressions below, we will need to control for this factor, especially to the extent that banks' size and capital shocks might be spuriously correlated.

### Econometric results

In order to test hypothesis 1, we estimate the following simple panel regression relationship:

$$SPA_{it} = \alpha_{0i} + \alpha_{0t} + \alpha_1 \Delta RP_t + \alpha_2 \Delta CPR_t + \alpha_3 \Delta GBL_{it} + \alpha_4 D_1 + \varepsilon_{it} \quad (1)$$

$$i=1, 2, \dots, 14 \text{ (banks); } t=1,2,\dots,13 \text{ (months)}$$

where, again, the dependent variable SPA is the spread between the overdraft rate and the corporate commercial paper rate.  $\Delta RP$  is the change in the rate of the central bank's RPs.  $\Delta RP$  is included to capture the stance of monetary policy. In fact, the Bank of Korea has increasingly resorted to market-based operations such as RPs involving government bonds, sales/redemption of Monetary Stabilization Bonds in the primary

market in order to control bank reserves.<sup>25</sup> Two explanatory variables are introduced in order to control for changes in the credit worthiness in the corporate sector ( $\Delta\text{CPR}$ , changes in the CP rate) as well as for flight-to-quality towards risk-free assets by banks ( $\Delta\text{GBL}$ , changes in ratio of individual bank's government bond holdings over the sum of government bonds plus bank loans). The dummy variable  $D_i$  is one for the period after the financial crisis (1997.12 ~ 1998.4) and is previously zero (1997.4 ~ 1997.11).<sup>26</sup>

Our model implies that, if bank lending channel effects are at work, overdraft rates should rise more than commercial paper rates would following the monetary shock. Furthermore, we should control for the likely event that SPA increased after the crisis, partly reflecting risk premium differentials between firms relying more on bank loans and firms having access to market debt. Thus, both  $\alpha_1$  and  $\alpha_4$  are predicted to be positive. The flight to quality – associated with an increase in government bonds within the bank asset portfolio – reduces bank loans and raises lending rates. The increase in corporate sector credit risk induces a rise in the associated risk premium of the lending rates. Thus, both  $\alpha_2$  and  $\alpha_3$  are predicted to be positive.

**Table 4: Panel Regression Estimates**

Dependent Variable: SPA						
Const.	$\Delta\text{RP}$	$\Delta\text{CPR}$	$\Delta\text{GBL}$	$D_i$	R <sup>2</sup>	F-Test
1.8715 (38.67)	0.2859 (7.76)	0.1184 (2.43)	14.3364 (3.76)	..	0.8923	0.5252
1.4712 (32.58)	0.1598 (5.35)	0.2681 (7.45)	3.9687 (1.15)	1.0199 (14.68)	0.8995	0.8242

Note: 1)  $D_i=1$  for the period of December 1997 – April 1998 and zero for the period of April 1997 – November 1997. 2) Figures in the parentheses are t-statistics. 3) F statistics are the results of testing the hypothesis of Fixed-effect model. They show the rejection of the null hypothesis of fixed effect at a 5% significant level.

Table 4 reports the results of estimating equation (1). The results lend support to the hypothesis. From the first specification, the coefficient on the changes in RP is positive, as predicted, and is statistically significant at the 1% confidence level.<sup>27</sup> Furthermore, in the second specification, we find confirmation that SPA is systematically larger after the crisis, but this does not eliminate the statistically significant relationship between SPA and  $\Delta\text{RP}$ .

<sup>25</sup> RPs are used when a discrepancy between the targeted and the actual levels of bank reserves is judged to be temporary or when there is a need to fine-tune short-term interest rates. In general, the 7 to 15-day term RPs are used to absorb (cover) reserve surpluses (shortages) while the very short-term (2-3 days) RPs are intended to modify day-to-day fluctuations in banks' reserve positions.

<sup>26</sup> The estimation of (1) is performed by including a lag 1 autoregressive term,  $\text{AR}(1)$ .

<sup>27</sup> Even though we do not report the regression output for each and every bank, we confirm that these coefficients are all positive and statistically significant at the 1% confidence level.

Testing hypothesis 2 is addressed by the following two equations (2) and (3).

$$\Delta LCL_{it} = \beta_{0i} + \beta_{0t} + \beta_1 \Delta RP_t + \beta_2 \Delta CPR_t + \beta_3 \Delta GBL_{it} + \beta_4 D_1 + \delta_{it} \quad (2)$$

$$SPA_{it} = \gamma_{0i} + \gamma_{0t} + \gamma_1 \Delta LCL_t + \gamma_2 \Delta CPR_t + \gamma_3 \Delta GBL_{it} + \gamma_4 D_1 + \lambda_{it} \quad (3)$$

$$i=1, 2, \dots, 14 \text{ (banks); } t=1,2,\dots,13 \text{ (months)}$$

where the  $\Delta LCL$  is the change in the log of overdraft credit limits. Again, the dummy variable ( $D_1$ ) has a value of 1 for the period following the financial crisis and is zero for the pre-crisis period. The estimation of (2) and (3) also includes an AR(1) term.

If  $\Delta LCL$  is a meaningful identifier of bank lending channel effects, it is expected to decrease following the monetary tightening (equation 2). At the same time, we expect that SPA increases (decreases) are linked to decreases (increases) in  $\Delta LCL$  (equation 3).

**Table 5: Panel Regression Estimates**

Dependent Variable: $\Delta LCL$						
Const.	$\Delta RP$	$\Delta CPR$	$\Delta GBL$	D1	R2	F-Test
-0.0097 (-2.61)	-0.0028 (-8.33)	0.0064 (1.76)	-0.3682 (-4.59)	..	0.3165	1.1147
0.0032 (4.57)	-0.0014 (-4.34)	-0.0010 (-2.94)	-0.2250 (-2.89)	-0.0136 (-10.61)	0.4052	1.2687

Note: 1) D1=1 for the period of December 1997 – April 1998 and zero for the period of April 1997 – November 1997. 2) Figures in parentheses are t-statistics. 3) F statistics are the results of testing the hypothesis of Fixed-effect model. They show the rejection of the null hypothesis of fixed effect at a 5% significant level. 4) Coefficients of AR(1) are dropped since they are not significant.

Tables 5 and 6 present the results of estimating equations (2) and (3). Table 5 shows that the monetary squeeze noticeably diminishes the percentage increase in overdraft credit limits ( $\Delta LCL$ ). In addition, as expected, we find that the expansion of overdraft credit limits is systematically reduced after the financial crisis.

**Table 6: Panel Regression Estimates**

Dependent Variable: SPA						
Const.	$\Delta LCL$	$\Delta CPR$	$\Delta GBL$	D1	R2	F-Test
1.8447 (30.68)	-9.4807 (-6.36)	0.3868 (16.66)	12.6021 (3.37)	..	0.7782	0.6902
1.4193 (23.19)	-2.8501 (-2.45)	0.4224 (37.02)	1.9554 (0.65)	1.1671 (13.58)	0.8824	0.6294

Note: 1) D1=1 for the period of December 1997 – April 1998 and zero for the period of April 1997 – November 1997. 2) Figures in the parentheses are t-statistics. 3) F statistics are the results of testing the hypothesis of Fixed-effect model. They show the rejection of null hypothesis of fixed effect at a 5% significant level. 4) The estimation is performed by including a lag 1 autoregressive term, AR(1).

Table 6 shows that, as predicted, the reduction in  $\Delta LCL$  widens the SPA (a 1% decrease in the log of overdraft credit limits is associated with a 2.9% increase in the spread between bank lending rates and commercial paper rates). Furthermore, different from what happens to  $\Delta GBL$ , this link stands up even after we include  $D_1$ . It is apparent that those firms experiencing a reduction in their credit limits suffer, not only because the availability of credit is likely to be insufficient, but also because the cost of credit has increased.

In this connection, it is particularly interesting to note that the expansion of overdraft credit limits has been systematically larger at those banks assigning a large fraction of their assets to corporate lending (*vis-à-vis* lending to individual businesses, to households or holding securities).<sup>28</sup> Since these banks are likely to be the counterparts of larger firms, this indirectly suggests that SMEs may have disproportionately suffered from the retrenchment in banks' supply of loans.

All in all, a close association of changes in the credit limits ( $\Delta LCL$ ) with the spread (SPA) suggests that  $\Delta LCL$  could be regarded as a direct indicator in identifying the bank lending channel effect.

Although some have claimed the existence of a credit crunch in East Asian crises countries, there is no evidence yet to suggest the possibility that this was triggered by a capital crunch. In this respect, Korea is an interesting case since the decision to stiffen capital requirements was enacted by national regulators immediately upon the inception of the crisis.

The capital crunch hypothesis predicts that poorly capitalized banks will contract deposits and loans more rapidly than better capitalized banks.<sup>29</sup> Applying the methodology put forth by Peek and Rosengren (1995) to Korean banks, and controlling for each bank's share of bad loans, we test the following three equations on data for a cross section of nation-wide and local banks:

$$\Delta D / A = a_0 + a_1 \Delta K / A + a_2 \text{Log}(A) + a_3 BLR + a_4 D_2 + \varepsilon \quad (4)$$

$$\Delta L / A = b_0 + b_1 \Delta K / A + b_2 \text{Log}(A) + b_3 BLR + b_4 D_2 + \varepsilon \quad (5)$$

<sup>28</sup> The following regression provides evidence that the expansion of overdraft credit limits is larger the larger the bank's share of corporate lending on total assets ( $L/A$ ). This suggests that if a firm borrows from a bank whose share of corporate lending out of total assets is small, the chances of being called in its existing loans are high.

Table: Dependent Variable:  $\Delta LCL$

Const.	$L/A$	$\Delta RP$	$\Delta CPR$	$\Delta GBL$	R2	F-Test
-0.0280	0.1039	-0.0025	0.0006	-0.3352	0.3943	0.9899
(-6.86)	(6.85)	(-8.94)	(1.92)	(-4.72)		

<sup>29</sup> See also Berger and Udell (1994) and Hancock, Laing and Wilcox (1995).

$$\Delta SPA = c_0 + c_1 \Delta K / A + c_2 \text{Log}(A) + c_3 BLR + c_4 D_2 + \varepsilon \quad (6)$$

Changes in equity capital, deposits, and loans have been normalized by the beginning-of-month value (alternatively 1996.12 and 1997.2) of total assets to reduce potential heteroskedasticity problems with the error term.

We perform the regressions referring only to December 1997 and February 1998 for the following two reasons. First, capital shortages were likely to be exacerbated after the stiffening of capital adequacy standards enacted in December of 1997.<sup>30</sup> Second, starting with early 1998, the data show increases in some banks' capital endowment. Given the extremely adverse market conditions, (some of) those capital increases might have been facilitated by some form of public sector intervention. Accordingly, we deemed it inappropriate to extend the analysis beyond February of 1998.

The model implies that capital-constrained banks which suffer negative capital shocks will shrink their deposits and loans, as well as increase their lending rates, more than well-capitalized banks, thus  $a_i$ ,  $b_i$  are predicted to be positive and  $c_i$  is predicted to be negative.

$\text{Log}(A)$  is a control variable to incorporate the fact that commercial banks are constrained not to lend more than 15% of their capital to any single borrower. The small banks are thus prevented from making large loans.  $BLR$  ( $NPLR$ ) controls for each bank's share of bad loans. We also include a dummy variable  $D_2$  – which has a value of 1 for nation-wide commercial banks and zero for local banks – to control for possible differences between these two types of banks.

**Table 7: Cross-Section Regressions (1996.12 - 1997.12)**

Dependent Variable	Constant	$\Delta K/A$	$\text{Log}(A)$	$BLR$	$D_2$	$R^2$
$\Delta D/A$	0.6335 (3.57)	2.2057 (2.94)	-0.0412 (-3.64)	-0.0189 (-0.89)	0.1238 (6.01)	0.7592
$\Delta L/A$	0.2667 (3.26)	1.4958 (4.28)	-0.0126 (-2.39)	-0.2899 (-3.10)	0.0101 (1.05)	0.7773
$\Delta SPA$	28.8320 (1.43)	-165.71 (-2.03)	-1.2245 (-0.98)	-1.3341 (-1.81)	2.8501 (1.34)	0.3110

Note: 1)  $D_2=1$  for nation-wide commercial bank and zero for local bank. 2) We detected a problem of error heteroskedasticity using Newey-West heteroskedasticity and autocorrelation consistent covariance matrix. So the results shown in Table 7 are heteroskedastic robust coefficients.

Tables 7 and 8 report the results of estimating equations (4), (5), and (6) for the following two periods: December 1996-December 1997 and February 1997-February 1998. The results for the specification provide support for the capital crunch hypothesis.

<sup>30</sup> In principle, the retrenchment in banks' loan supply need not be policy induced: banks may become more conservative or risk averse. One could even think that, quite paradoxically, better capitalized banks – which have more to lose – behave as if they were more constrained than less capitalized ones that may actually be “gambling” into more and more lending. However, as capital requirements are increased, this could only happen if supervision is not intensified at the same time.

The coefficient on changes in capital is positive, as predicted, and statistically significant at the 1% confidence level in each of the regressions. The coefficient of  $D_2$  has a statistically significant positive relation with the changes in deposits. This seems consistent with the hypothesis that depositors may have enacted a flight-to-quality away from banks perceived to be weaker (the small-sized, local banks) towards those (the nation-wide, larger banks) perceived as less likely to go bankrupt. To the extent that the flight-to-quality took place particularly in December of 1997<sup>31</sup> and may have been partially offset thereafter, it is interesting to notice that the coefficient of  $D_2$  is smaller in Table 8 than in Table 7.

**Table 8: Cross-Section Regressions (1997.2 - 1998.2)**

Dependent Variable	Constant	$\Delta K/A$	$\text{Log}(A)$	NPLR	$D_2$	$R^2$
$\Delta D/A$	0.7701 (3.27)	1.2019 (2.20)	-0.0444 (-2.94)	-0.0102 (-2.85)	0.0819 (3.14)	0.6075
$\Delta L/A$	0.4040 (3.81)	0.5475 (2.22)	-0.0188 (-2.76)	-0.0114 (-7.09)	0.0252 (2.15)	0.7838
$\Delta SPA$	2.6022 (0.52)	-26.830 (-2.45)	-0.1227 (-0.38)	0.0645 (1.05)	0.6391 (1.27)	0.2527

Note: 1)  $D_2=1$  for nation-wide commercial bank and zero for local bank. 2) We detected a problem of error heteroskedasticity using Newey-West heteroskedasticity and autocorrelation consistent covariance matrix. So the results shown in Table 8 are heteroskedastic robust coefficients.

Furthermore, from equation (6), the coefficient on the changes in capital ( $c_t$ ) is negative, as predicted, and statistically significant. This negative relationship between shocks to capital and SPA shows us that the capital crunch hypothesis can also be confirmed through price-effects ( $\Delta SPA$ ) and not only via quantitative-effects based on changes in deposits and loans.

In sum, the results in Tables 7 and 8 support the capital crunch hypothesis: banks with low equity capital more rapidly shrink their lending and deposits and more substantially raise lending rates, supposedly in order to boost their capital adequacy ratios.

<sup>31</sup> Although the Government extended a blanket guarantee on deposits, depositors might still prefer to avoid failing banks because of the lengthy procedures to recover deposits. For example, even after the announcement of the blanket guarantee, depositors' withdrawals from failed financial institutions were temporarily frozen. Furthermore, the government guarantee did not cover bank's trust accounts – a form of savings bearing higher interests than normal deposits and one that is quite popular in Korea.

## Conclusion

In this paper we have investigated whether credit channel effects – specifically bank lending channel effects – exacerbated the Korean crisis in the aftermath of both the unprecedented devaluation of the won and stiffening of monetary policy.

Our main objective was to shed light on the identification of the determinants of the decline in credit following the monetary restriction. Specifically, we wanted to differentiate the supply determinants, stemming from the growing unwillingness of Korean banks to lend, from the demand determinants, deriving from the slowdown in production and investment. To that end, we resorted to various identification strategies, partly borrowing from the literature and partly innovating by applying these methodologies to micro-data for Korean banks. This allows us to free our results from the many objections usually levied on results based on the analysis of aggregate variables.

Our three main results may be summarized as follows. First, consistent with a bank lending channel at work, monetary tightening broadens the spread between marginal lending rates and corporate commercial paper rates for most of the banks. Second, credit limits on overdrafts – used as a more direct identification proxy variable for shifts in loan supply – react negatively to the monetary squeeze. Wider lending rate increases are observed in those banks where the slowdown in credit limits was more intense. Third, there is a positive link between shocks to individual banks' capital and their changes in deposits. Banks suffering from larger negative capital shocks also experience a more marked slow-down in the expansion of loans and also disproportionately raise their lending rates.

On the basis of these results, we can claim that the decline in credit expansion has, to some extent, been the result of intensified credit rationing and higher lending rates.

Finally, our results warrant some policy recommendations. To the extent that banks' supply retrenchment has magnified the impact of the monetary and financial shocks hitting the Korean economy, attention should be paid to measures that can compensate for such undesired outcomes. We can tentatively list two of them. First, it seems desirable to provide relief – possibly through market-based actions – to those particular business segments, such as the SMEs, that unduly suffer from the credit crunch. Second, in order to lower obstacles to recovery, market-based incentives should be devised to secure that bank loans will be available for healthy firms in sectors, such as the export sector, on which recovery supposedly must hinge.

## REFERENCES

- Angeloni, I., L. Buttiglione, G. Ferri and E. Gaiotti (1995), "The Credit Channel of Monetary Policy Across Heterogeneous Banks: The Case Study of Italy", *Temi di Discussione*, n. 256, Banca d'Italia, Rome.
- Berger, A.N., and G.F. Udell (1994), "Did Risk-Based Capital Allocate Bank Credit and Cause a 'Credit Crunch' in the United States?", *Journal of Money, Credit, and Banking*, 26, pp. 585-628.
- Berger, A.N., A.K. Kashyap, and J.M. Scalise (1995), "The Transformation of the U.S. Banking Industry: What a Long, Strange Trip It's Been", *Brookings Papers on Economic Activity*, 2, pp. 55-218.
- Bernanke, B.S., and M. Gertler (1995), "Inside the Black Box: The Credit Channel of Monetary Policy Transmission", *Journal of Economic Perspectives*, 9, pp. 27-48.
- Bernanke, B.S., and C. Lown (1991), "The Credit Crunch", *Brookings Papers on Economic Activity*, 2, pp. 205-39.
- Bernanke, B.S., M. Gertler, and S. Gilchrist (1996), "The Flight to Quality and the Financial Accelerator", *Review of Economics and Statistics*, 78, pp. 1-15.
- Bongini, P., G. Ferri, and H. Hahm (1998), "Corporate Bankruptcy in Korea: Only the Strong Survive?", *World Bank EAP Working Paper Series*, No. 98-02, Washington, DC.
- Caprio, J.G., Jr. (1998), "Banking on Crises: Expensive Lessons from Recent Financial Crises", *World Bank, Policy Research Working Paper*, No. 1979, Washington, DC.
- Conigliani, C., G. Ferri, and A. Generale (1997), "The Impact of Bank-Firm Relations on The Propagation of Monetary Policy Squeezes: An Empirical Assessment for Italy", *Quarterly Review/Banca Nazionale del Lavoro*, 50 (202), September, pp. 271-99.
- Corsetti, G., P. Pesenti, and N. Roubini (1998), "Paper Tigers? A Preliminary Assessment of the Asian Crisis", paper prepared for NBER-Bank of Portugal, International Seminar on Macroeconomics (ISOM), Lisbon (June 14-15, 1998).
- Council of Economic Advisor (1992), "The Economic Report of the President", *United States Government Printing Office*, Washington, DC.
- Ding, W., I. Domaç, and G. Ferri (1998), "Is There a Credit Crunch in East Asia?", *World Bank, Policy Research Working Paper*, No. 1959, Washington, DC.
- Domaç, I., and G. Ferri (1998), "The Real Impact of Financial Shocks: Evidence from Korea", *World Bank, Policy Research Working Paper*, No. 2010, Washington, DC.
- Furman, J., and J. Stiglitz (1998), "Economic Crisis: Evidence and Insights from East Asia", paper prepared for the Brookings Panel on Economic Activity, Washington, DC, (September 3-4).
- Gertler, M., and S. Gilchrist (1994), "Monetary Policy, Business Cycles and the Behavior of Small Manufacturing Firms", *Quarterly Journal of Economics*, 109, pp. 309-40.
- Ghosh, S. (1998), "Korea in the Aftermath of the Crisis: Credit Crunch or Lack of Demand?", *World Bank, mimeo*, November, Washington, DC.
- Goldstein, M. (1998), "The Asian Financial Crisis: Causes, Cures, and Systemic Implications", *Policy Analysis in International Economics*, Institute for International Economics, Washington DC.
- Hancock, D., A.J. Laing, and J.A. Wilcox (1995), "Bank Capital Shocks: Dynamic Effects on Securities, Loans, and Capital", *Journal of Banking & Finance*, 19, pp. 661-77.
- Holstrom, B., and J. Tirole (1997), "Financial Intermediation, Loanable Funds, and the Real Sector", *Quarterly Journal of Economics*, 112, pp. 663-91.
- Hubbard, R. G. (1995), "Is There a Credit Channel for Monetary Policy?", *Economic Review of the Federal Reserve Bank of St. Louis*, 77, May/June, pp. 63-77.



- Kashyap, A.N., and J.C. Stein (1994), "Monetary Policy and Bank Lending", In N.G. Mankiw (ed.), *Monetary Policy*, University of Chicago Press, Chicago.
- Kashyap, A.N., and J.C. Stein (1997), "What Do a Million Banks Have to Say About the Transmission Mechanism of Monetary Policy?", *NBER Working Paper* No. 6056, June.
- Kim, H.E. (1998), "A Credit Channel as the Key Transmission Mechanism Underlying the Recent Financial Crisis in Korea", *World Bank, mimeo*, November, Washington DC.
- Krugman, P. (1998), "Saving Asia: It Is Time to Get Radical", *Fortune Investor*, September.
- Morgan, D.P. (1998), "The Credit Effects of Monetary Policy: Evidence Using Loan Commitment", *Journal of Money, Credit and Banking*, 30, pp. 102-118.
- Pazarbasioglu, C. (1997), "A Credit Crunch? Finland in the Aftermath of the Banking Crisis", *IMF Staff Papers*, 44, pp. 315-27, Washington, DC.
- Peek, J., and E. Rosengren (1995), "The Capital Crunch: Neither a Borrower nor a Lender Be", *Journal of Money, Credit and Banking*, 27(3), pp. 625-638.
- Sharpe, S. (1995), "Bank Capitalization, Regulation, and the Credit Crunch: A Critical Review of the Research Findings", DP 95-20, Financial and Economics Discussion Series, *Board of Governors of the Federal Reserve System*, Washington, DC.
- Stiglitz, J., and A. Weiss (1981), "Credit Rationing in Markets with Imperfect Information", *American Economic Review*, 71(2), pp. 393-410.
- World Bank. (1998), "East Asia: The Road to Recovery", *World Bank*: Washington DC.